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U.S. EPA Region 5
77 W. Jackson Blvd.
Chicago, IL 60604-3507

Subject: Detrex's Proposed Source Control Enhancements
Fields Brook Superfund Site, Ashtabula, Ohio

Dear Leah:

Gradient and FBAG have reviewed Detrex's proposed Source Control enhancement proposal[1] and other related documents.[2,3] The Detrex Source Control enhancement proposal is inadequate relative to the scale of the DNAPL problem and will not accelerate DNAPL removal rates, a critical and urgent performance criterion for effective source control. Until mobile DNAPL is reduced to residual state, it will continue to migrate in multiple directions from the source zone and impact Fields Brook and the completed remedial actions. The current Detrex pilot system suffers from several design deficiencies and is operated sub-optimally by Detrex. Consequently, DNAPL thicknesses within the limited area influenced by the pilot system have not declined in over 6 years of operation. On the order of 10 feet of DNAPL continually accumulates in wells (see attached Figure 1) despite over 15,000 gallons of DNAPL having been removed. This is clear evidence that DNAPL in the source area is mobile. Given the limited spatial coverage of the current system, the vast majority of DNAPL that is present at the Detrex facility migrates *via* multiple subsurface preferential pathways (*e.g.*, clay fractures, utilities such as the CEI conduit and the North Sewer) away from the pilot system. Detrex needs to take aggressive source remediation steps now to address this serious issue.

1. The current Detrex Source Control system is under-sized, poorly designed, and does not utilize EPA-recommendations/Best Practices for Soil Vapor Extraction/Dual Phase Extraction (SVE/DPE) systems.

The current Detrex SVE/DPE system is a small pilot unit installed in October 2002 that which was never "scaled-up." The system consists of 12 two-inch diameter extraction wells, which affect only a small fraction of the 500,000 square foot DNAPL source area (note, the 1997 ROD design called for 40 wells). In addition, the system design does not conform to best practices set forth in EPA guidance[4] for SVE/DPE systems and has the following major deficiencies:

- The current SVE/DPE well configuration (a V-like shape) does not provide adequate spatial coverage over the DNAPL footprint to efficiently remove contaminants. In low permeability soils, the radius of influence associated with a

[1] URS Corporation. 2008. Interim Operations and Maintenance Manual, Detrex RD/RA Source Control Area – Detrex Facility, Ashtabula, Ohio. June 2008.
[2] URS Corporation. 2004. Operation & Maintenance Manual, Source Control & Vacuum-Enhanced DNAPL Recovery System – Detrex Facility, Ashtabula, Ohio. March 2004.
[3] Detrex Corporation. 2009. Monthly Status Report – April 2009, Fields Brook Superfund Site, Detrex Source Area, Ashtabula, Ohio. May 14, 2009.
[4] US EPA. 2004. How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites – A Guide for Corrective Action Plan Reviewers. Office of Solid Waste and Emergency Response. EPA 510-R-04-002. May 2004.

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SVE/DPE well is small, thereby requiring a closely spaced network of wells. Typically, spacing of SVE/DPE wells is defined on the basis of radius of influence data collected during a pilot test. It is not clear that such information has been collected at the site. Absent such site-specific data and using a typical radius of influence of 5 feet for fine grained soils (USEPA, 2004), the current system covers less than 1% of the 500,000 square feet DNAPL plume defined in the 1997 ROD. Even if the site-specific radii of influence were somewhat higher, the current system's spatial coverage is extremely small given the extent of contamination.

- The vacuum SVE/DPE blower being utilized is inappropriate for the site's sub-surface conditions. In low permeability silt/clay soils found at the Detrex facility, a high-vacuum blower (rotary lobe or liquid ring) is needed to effectively extract contaminant mass (USEPA, 2004). However, the Detrex system utilizes a mid-range vacuum pump that is not appropriate for the site, resulting in sub-optimal contaminant removal rates.

- The small diameter (2-inches) of the SVE/DPE wells limits the operational efficiency of the system and greatly limits operational flexibility. For example, if the wells were 4-inch in diameter, a submersible water withdrawal pump could be placed in the well to simultaneous remove DNAPL and groundwater, while the vacuum pump extracts vapors – a proven approach known as Vacuum Enhanced Pumping (VEP).

- Finally, air injection wells are often required in low permeability soils/strata to provide the necessary air flow and to prevent short-circuiting of extraction wells (USEPA, 2004). Such wells have not been installed.

2. The Detrex Remedy is not being operated efficiently and the operational problems are a manifestation of the poor design.

Although the SVE/DPE wells have an approximately 15 feet long well screen, only the lower 1 to 2 feet is "open," with the remainder having been blocked off using a solid riser. This design modification and the manner in which the system is being operated (*i.e.*, only during business hours) are key elements contributing to the poor perceived system performance.

- Since a majority of the SVE/DPE well screen is blocked off and groundwater and DNAPL (total liquid thickness of approximately 15 feet) accumulates in the wells, it does not appear that any air flow is induced in the subsurface by vacuum application.[5] Therefore, the current system is largely removing liquids and very limited vapors – an extremely inefficient approach for remediating a VOC-dominant DNAPL that is best remediated by vapor removal.

- Detrex's decision to operate the system manually, only during business hours, is extremely inefficient and inexplicable. The intermittent operation of the system allows groundwater to flow back into wells when the system is not operating – a less than ideal scenario. For effective contaminant mass removal in this setting, the sub-surface needs to be dewatered by continuous groundwater extraction, in conjunction with vapor flow induced by vacuum application.

[5] We could not find any air flow rate or VOC vapor removal rate data in the Detrex documents (*e.g.*, in the O&M report). Such data are critical for understanding system performance and is typically presented in O&M reports.

- The remedy system O&M difficulties reported by Detrex (*e.g.*, well siltation) is a symptom of poor system design and operation. These O&M difficulties could be caused by the poor choice of vacuum blower and inappropriate sizing of the well's filter pack. DPE/SVE is a proven technology and has been effectively applied at numerous sites around the country in similar low permeability settings. Therefore, the operational difficulties are a design, and not a technology efficacy issue.

3. Despite the system's limitations, it continues to recover DNAPL mass – an indication of the volume of DNAPL present in the sub-surface.

The system has recovered 15,680 gallons of DNAPL as of April 2009, a remarkably large volume, given the limited scale of the system and the inefficient manner in which it is being operated. However, DNAPL thicknesses have not declined appreciably since system operations began and DNAPL continues to flow into the wells (Figure 1). These findings are important for two reasons:

- First, continued DNAPL accumulation in wells is clear, indisputable indication of its subsurface mobility. Furthermore, DNAPL migration into the pilot system's area of influence, only a small fraction of the larger plume area, causes major concern over the fate of the mobile DNAPL beyond the area of influence of the extraction wells.
- Second, the collection of this volume of DNAPL in a poorly designed, sub-optimally operated pilot-scale system is clear indication of the vast DNAPL reservoir (previously estimated to be at least 250,000 gallons) that remains at the Detrex facility. In addition, these DNAPL recovery data demonstrate that much higher DNAPL recovery, a critical component of effective source control, can be achieved at the Detrex site using a properly designed, installed and operated system.

4. The proposed system enhancements are inadequate; Detrex needs to take more aggressive steps to enhance DNAPL and contaminant mass recovery.

Detrex proposes a gravity-drain system consisting of a line of wells or a collection trench along a portion of the northern Detrex property boundary. Accumulated DNAPL will be pumped out monthly. This proposed system is technically ineffective and spatially deficient because:

- The proposed "enhancements" are “passive” systems (monthly DNAPL removal) similar to the current Detrex system, which is being operated manually at an unknown frequency. Consequently, the enhancement will likely further reduce DNAPL removal rates, not increase them.
- The focus on a limited area to the north of the source area is perplexing in that it does not focus on identified preferential pathways (*e.g.* CEI conduit and the North Sewer) that require immediate action to prevent continued impacts to Fields Brook.

What is needed is an aggressive system that actively targets and removes DNAPL and VOC mass from the sub-surface. The system needs to be designed to achieve the critical source control objective of reducing DNAPL to a residual, non-mobile state, and to do so in a timely manner. This means that it not only needs to be properly designed, but also correctly located spatially and effectively operated until the design objectives are achieved. USEPA (2004) clearly states that an SVE/DPE system will recover more DNAPL overall and at a faster rate than a gravity drain system[6].

Finally, a properly designed and implemented SVE/DPE system is an essential building block for remediating such a site and can later be augmented by more aggressive in-situ thermal treatment technologies (*e.g.*, steam injection, six-phase heating, *etc.*). The scientific literature is replete with case studies of successful application of SVE/DPE-based applications in geologic formations and under similar conditions to that at Detrex's property.[7,8] It has been done elsewhere and urgently needs to be done here.

Overall, Gradient and FBAG believe that Detrex needs to implement more effective source remediation measures immediately at their property. We would be happy to further discuss our thoughts on this topic at your convenience.

Please feel free to call me if you have questions or would like to discuss this further.

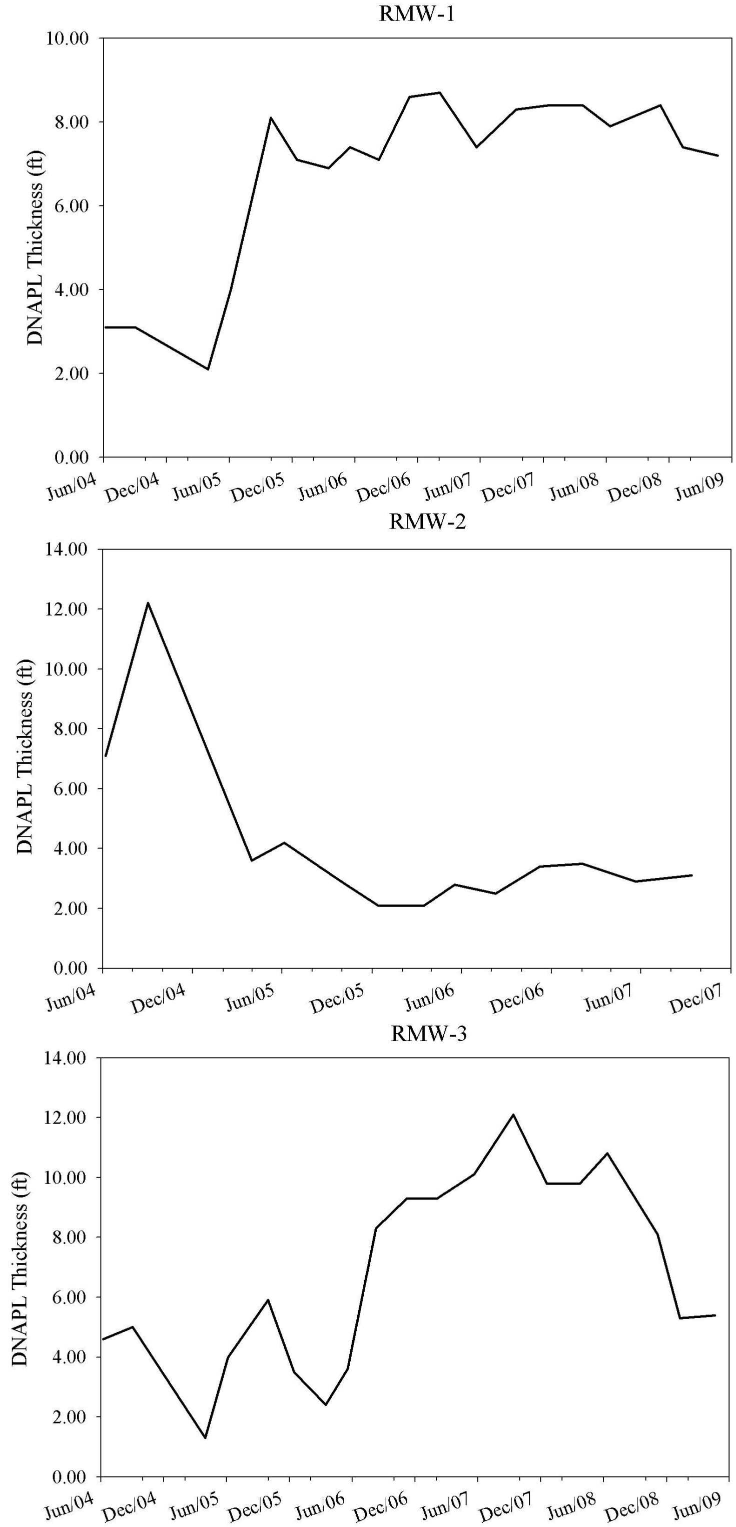
Yours truly,

GRADIENT CORPORATION

Manu Sharma, P.E.
Principal

[6] US EPA. 2004. How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites – A Guide for Corrective Action Plan Reviewers. Office of Solid Waste and Emergency Response. EPA 510-R-04-002. May 2004.
[7] US EPA. 2004. In-situ Thermal Treatment of Chlorinated Solvents: Fundamentals and Field Applications. Office of Solid Waste and Emergency Response. EPA/542-R-04-010. March 2004.
[8] US EPA. 2000. Dense Non-Aqueous Phase Liquids (DNAPLs): Review of Emerging Characterization and Remediation Technologies. Interstate Technology and Regulatory Council (ITRC). June 2000.

Figure 1
DNAPL Thicknesses Observed in Detrex Source Control Monitoring Wells
Detrex Facility, Fields Brook Superfund Site, Ashtabula, OH



Source: Detrex Corporation. 2009. Monthly Status Report – April 2009, Fields Brook Superfund Site, Detrex Source Area, Ashtabula, Ohio. May 14, 2009.